Summary of Seabird Bycatch in Alaskan Groundfish Fisheries, 1993 through 2006

Contributed by: Shannon Fitzgerald, NMFS, Alaska Fisheries Science Center, Seattle, WA; Mike Perez, NMFS, Alaska Fisheries Science Center, Seattle, WA; Kim Rivera, NMFS Alaska Region Office, Juneau, AK
Contact: Shannon.Fitzgerald@noaa.gov

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Introduction

This document provides a summary of seabird bycatch in federal groundfish fisheries in Alaskan waters from 1993 through 2006. Information that describes fisheries, vessel operations, observer sampling methodology, or analytical processes for estimation are available elsewhere (see Web links below). The purpose of this report is to make the estimates of seabird bycatch in federal groundfish fisheries available annually to the public.

Estimates of seabird bycatch from Alaskan groundfish fisheries are completed by NOAA Fisheries' Alaska Fisheries Science Center (AFSC) staff each year using two sources of information. The first is data obtained from the AFSC Observer Program (Observer Program). These data are composed of, among other information, total catch and species composition from direct monitoring of fishing operations by NMFS-certified groundfish observers (AFSC 2006). The second source of information is from the Alaska Regional Office catch accounting system that reports total catch. Observer methods are detailed in the North Pacific Groundfish Observer Program Documents while a description of the catch accounting database is available at Alaska Groundfish Catch Accounting System. Staff at the AFSC National Marine Mammal Laboratory analyze the data using ratio-estimation techniques similar to that used in the estimation of marine mammal incidental takes (Perez 2006).

Groundfish fisheries include fixed gear (pot and demersal longline) and trawl gear in federal waters of the Alaskan EEZ. Fishing takes place in three areas defined in North Pacific Fisheries Management Council Fishery Management Plans – the Aleutian Islands (AI), Bering Sea (BS), and the Gulf of Alaska (GOA). The Alaskan Groundfish fishery is described in detail in the Alaska Groundfish Fisheries Final Programmatic SEIS (NMFS 2004).

Fishery Interactions

Seabird bycatch summarized here is reported by the species or reporting groups developed in consultation with the U.S. Fish and Wildlife Service Migratory Birds Management Division (Anchorage, Alaska) (Table 8). At least 23 individual species, represented as a species or unidentified category, have been taken in the groundfish fisheries, including Laysan albatross (*Diomedea immutabilis*), black-footed albatross (*Diomedea nigripes*), short-tailed albatross (*Phoebastria albatrus*), Northern fulmar (*Fulmarus glacialis*), sooty shearwater (*Puffinus griseus*), short-tailed shearwater (*Puffinus tenuirostris*), unidentified storm petrel (*Oceanitidea*), herring gull (*Larus argentatus*), glaucus gull (*Larus hyperboreus*), glaucus-winged gull (*Larus glaucescens*), black-legged kittiwake (*Larus tridactyla*), red-legged kittiwake (*Larus brevirostris*), thick-billed murre (*Uria lomvia*), common murre (*Uria aalge*), tufted puffin (*Fratercula cirrhata*), king eider (*Somateria spectabilis*), loon unidentified (*Gaviidae*), grebe unidentified (*Podicipedidae*), cormorant unidentified (*Phalocrocoracidae*), jaeger/skua unidentified (*Stercorarius spp.*), tern unidentified (*Sternidae*), guillomot unidentified (*Cepphus spp.*), auklet/murrelet unidentified (*Alcidae:* several genera).

The estimates provided here are based on observer sample data only. Seabird mortalities do occur in association with vessels but are outside of normal sampling protocols. These mortalities, such as vessel collisions or interactions with trawl net or sonar cables, are not represented in the estimates provided in this report.

Bycatch in Longline Fisheries: Longline, or hook and line, fisheries in Alaskan waters are demersal sets that target groundfish or halibut. Observer coverage is not required in the halibut fishery, so information reported here are for demersal groundfish longline fisheries only, although that information does include some operations where halibut was retained due to individual fishing quota shares being available while fishing for groundfish. Longline fisheries in the BS and AI Regions are typically undertaken by vessels that are larger, stay at sea longer (up to 30 days), have onboard processing abilities, target Pacific cod (*Gadus macrocephalus*) and Greenland turbot (*Reinhardtius hippoglossoides*), use auto-bait systems, and deploy up to 55,000 hooks per day (Melvin et al. 2001). Conversely, longline vessels in the GOA typically are smaller, have shorter trip lengths (6 days), deliver bled fish on ice to shoreside processing plants, target sablefish (*Anoplopoma fimbria*), use tub or hand bait gear, and deploy up to 10,500 hooks per day (Melvin et al. 2001).

The total estimated seabird bycatch in 2006 was 4,530 birds representing a 29% decrease from 2005. This is the second lowest annual total (Table 9, Figure 73). Between 1993 and 2006 the average annual bycatch in the combined Alaskan longline fisheries was 12,021 birds (Table 9). Large inter-annual variation in seabird bycatch was common through 2001, even after the implementation of the first generation of seabird avoidance regulations in 1997 (Figure 73). With the use of seabird mitigation gear in the form of streamer lines seabird bycatch has been relatively stable. Seabird bycatch is highest in the BS, where fishing is prosecuted predominantly by cod freezer longliners (Melvin et al. 2001), and lower in the AI and GOA Areas (Tables 10-12, Figure 74). The average annual bycatch for all demersal groundfish fisheries (excludes Pacific Halibut) in Alaska during the period 2002-2006 was 5,138 (Table 9). Species composition during this period (with the average number in parenthesis) was: Northern fulmar – 39% (2,046); Gull sp. – 39% (2,019); shearwater sp. – 8% (432); unidentified birds – 7% (378); Laysan albatross – 2% (102); black-footed albatross – 2% (82); and unidentified procellarid, alcid sp., and other species categories all at 1% with 26 birds each. There was an annual average of 2 unidentified albatross at < 1%. Figure 75 depicts the general species composition by region for this time period. In 2006, the predominant bycatch species group was Gulls (2,161) followed by Northern fulmars (1,454), shearwaters unidentified (428), and unidentified birds (285). A total of 192 albatross were taken (see below).

Total seabird bycatch is the result of overall fishing effort and catch rate. Generally, while overall effort increased from 1993 to 2003, the bycatch rates decreased substantially (Figure 76). During 1993-2006, the average annual bycatch rates (birds per 1,000 hooks) were 0.050 overall. The rates for this time period in the AI, BS, and GOA areas were 0.061, 0.057, and 0.019 respectively (Table 9). Those rates have dropped in the last few years, with the running 5-year average now (2002-2006) at 0.018, 0.019, and 0.008 for AI, BS, and GOA respectively, with an overall rate of 0.017 for all regions combined. In the AI, effort and bycatch have generally tracked together (Figure 77). Catch rates have declined while effort has trended upwards in the BS (Figure 78). In the GOA, effort was low and bycatch rates were their highest in 1998. Since then, effort has nearly doubled while bycatch rates have dropped dramatically (Table 9, Figure 79), although both the bycatch rate and effort increased from 2005 to 2006. In all three regions, bycatch rates were quite variable from year to year prior to 2001 and have stabilized at much lower rates since then, matching the period when streamer line use began. Bycatch rates in all three regions have been decreasing since highs in the 1998-1999 period.

Albatross bycatch has fallen drastically, with the lowest totals in 2002 but relatively low numbers since then (Figure 80). Although the proportion of unidentified albatross was high in early years, improved training and albatross identification materials have reduced the overall number of unidentified albatross (Figure 80 and Tables 10-12). The bycatch of black-footed albatross (BFAL) exceeded that of Laysan albatross in only 2 years – 1991 and 2006. Regionally, we see the highest Laysan albatross bycatch in the AI, followed by the BS and lowest in the GOA (Figure 81). The reverse is true for black-footed albatross, which are caught predominantly in the GOA. These regional patterns are reflected in the primary, or

target, fisheries that operate in each area. BFAL are caught in the IFQ sablefish/halibut fishery, accounting for 85% of the take, while the cod freezer longline fishery accounts for 15% (Figure 82). Laysan albatross bycatch was distributed more evenly, with 54% of the bycatch in the IFQ fishery and 45% in the open-access freezer longliner fishery for cod and turbot (Figure 83). The total estimated mortality of albatross in 2006 was 57 Laysan and 135 black-footed albatross.

The substantial reduction in seabird bycatch starting in 2001 can likely be attributed to seabird mitigation measures. Washington Sea Grant, in collaboration with the longline industry and NOAA Fisheries, conducted research on seabird mitigation gear during 1999 and 2000 (Melvin et al. 2001). Paired streamer lines meeting specific performance standards had proven to be very effective in reducing seabird bycatch during this study. In 2002 many freezer-longliners fishing in the BSAI adopted the use of streamer lines and the performance standards recommended by Melvin et al. (2001). NMFS completed the revisions to seabird avoidance regulations that made seabird avoidance measures mandatory for all longline vessels in February 2004. Among other requirements, vessels longer than 55 feet in overall length must use paired streamer lines except in certain weather conditions. During the period before widespread use of streamer lines (1993 through 2000) the average annual seabird bycatch rate was 16,507. In the 5 years since streamer line use has become widespread and later required by regulation (2002-2006) the annual average bycatch of seabirds was 5,138. There is a pronounced change in the average bycatch levels calculated for the 5-year periods before and after streamer lines were adopted (Figure 84). The Washington Sea Grant research indicated that streamer lines were especially effective for deterring albatross. The average annual albatross bycatch for 1993 through 2000 was 1,051 while the annual average between 2002 and 2006 was 185, an 83% reduction. In 2004, groundfish observers also began recording results of the use of seabird mitigation gear on vessels 60 feet length overall and greater. Since then observers have checked 66% of longline sets and observed that single or double streamer lines were used in 96.1% of those sets (Table 13). Compliance appears to be near 100% given allowances to not use seabird mitigation gear in heavy weather due to concerns for crew safety.

Pot: Seabird bycatch from groundfish pot fishing has traditionally been very limited. The overall average bycatch in this fishery, 1993 through 2006, is 73 seabirds (Table 14). In 2006 the 17 observed takes led to an estimated total of 230 birds, the highest number recorded to date. No albatross have been taken in pot gear. Northern fulmars accounted for 219 of the 230 estimated birds in 2006. These surface-feeding birds obviously did not enter the pot while it was actively fishing on the bottom. Previous speculation that these birds entered the pots while the ship was in transit and died inside, and were thus set with the pot, have recently been corroborated by several groundfish observers.

Trawl: Seabird bycatch in trawl fisheries are reported in Tables 15 to 17 and in Figures 85 through 92. We previously reported two alternative estimates for seabird bycatch in the Alaskan trawl fleet. This was due to not having recorded the sample size used to monitor for seabirds during zero seabird bycatch hauls (observers were instructed to use the largest sample available, but not all observers did this). The issue was resolved in 2004, when the sample size used for monitoring was always recorded whether birds were taken or not. Based on estimates derived since then and other parameters we are able to determine which alternate to use for the 1993 through 2003 period. The remainder of this section provides what we determine to be the best available estimate. However, these estimates are biased low. The estimates reported represent only those birds in the observer sample. The sample is taken from the fish catch, which is contained by the codend (Figure 85). From reports in other trawl fisheries globally, and from ad hoc reports by groundfish observers on Alaskan trawl vessels, we know that seabird mortalities occur from birds encountering trawl cables. This includes the main cables that run from the winches, through heavy blocks, and into the water down to the trawl doors known as main wires or warps. It also applies to the smaller cable known as the third wire that runs from the upper stern deck down to the trawl sonar package attached to the headrope. Seabirds on the water and in the air can collide with these wires. While many of these collisions are harmless, some can lead to mortalities (Melvin et al. in prep). We

have reports from observers on fulmar mortalities from warps and third wires in pollock, cod, and Atka mackerel fisheries, and of Laysan albatross in the catcher/processor cod fishery in the AI and BS. We are currently unable to derive estimates from these, although some pilot work has been done to explore other means of monitoring (McElderry et al. 2004). Dietrich and Melvin (2007) provide a first attempt at characterizing albatross bycatch in these trawl fisheries and discuss where attention should first be focused for additional monitoring projects.

In 2006 an estimated 2,873 seabirds were taken in the Alaskan groundfish trawl fleet, an 84% increase over the 1,561 seabirds from 2005. The estimates derived from observer sampling average 934 birds per year, 1993-2006, with low numbers throughout but increasing during 1996-1998, remaining near 1,000 birds per year through 2004, then increasing again in 2005 and 2006 (Figure 86). By region, seabird bycatch is lowest in the GOA and generally higher in the BS, with the AI being intermediate but highest in 1993, 1996, 2001, and 2003 (Figure 87). Northern fulmars are again the most common species taken, constituting about 36% of the overall seabird bycatch in the combined groundfish trawl fleet when using the 1993-2006 average annual estimates (Figure 88). That composition stays about the same, 37%, when using the 2002-2006 annual average estimates (Figure 89). When using the 2000 through 2004 annual average estimate however, fulmar bycatch is about 76% (Tables 15-17). These large changes are due to large estimates in some years for species groups such as unidentified birds (2,092 in 2006 but 89 on average otherwise).

The highest annual average seabird bycatch (2002-2006) occurred in the Pacific cod fishery and the pollock fishery had the second highest seabird bycatch (Figure 90). Pollock however had a total catch that far exceeded the other target fishery and thus had a very low overall bycatch rate. The cod fishery, with its much lower total catch, had the highest bycatch rate. The flatfish fisheries also had a low catch rate.

Albatross bycatch in the groundfish trawl fleet includes only unidentified (1993, 1995 and 2006) and Layson albatross (Figure 91). No black-footed or short-tailed albatross have been recorded by observers, either as part of their sample or from other sources of mortality. Short-tailed albatross have been seen around trawl vessels however. Because of their proximity, and the use of Laysan albatross mortalities as a proxy, the trawl fleet was included in the Short-tailed albatross biological opinion (USFWS 2003). Work has since been accomplished to characterize the likely interaction between albatross species and groundfish trawl fisheries (Dietrich and Melvin 2007) and to develop means of assessing the risk to short-tailed albatross recovery (Zador et al. 2008a) or the likelihood of interactions based on fishery sectors and short-tailed sightings (Zador et al. 2008b). During 2002-2006, the bycatch of Laysan albatross appears to mostly be an issue for fisheries operating in the AI, with very limited takes in the BS (Figure 92). No albatross were taken in the GOA during this period.

Several projects are underway to further explore trawl cables (warps, third wires, and paravanes) as a source of mortality for seabirds on trawl vessels. An observer special project was done during 2004-2006 and will be implemented again for the 2008 season. A preliminary report on the first period is currently in preparation. A collaborative project was started in 2004 between the Alaska Fisheries Science Center and the Pollock Conservation Cooperative to promote development of seabird mitigation measures for groundfish catcher processor vessels. Funds were obtained from the NOAA Fisheries National Cooperative Research Program to assist with the development of these measures. Parallel to that, the Pollock Conservation Cooperative had been collaborating with Washington Sea Grant to conduct some preliminary work on interaction rates and further develop protocols drafted by Sea Grant, AFSC and University of Washington staff to be able to develop a rigorous field test of these measures (Melvin et al. 2004). Washington Sea Grant coordinated with the Pollock Conservation Cooperative (with support from the AFSC and USFWS) to conduct such a rigorous test of these gear under commercial fishing conditions in the summer of 2005. A report of that work is also in prep (Melvin et al. in prep). In addition,

Washington Sea Grant, with partial financial support from the National Seabird Program completed an extensive study to characterize the trawl fleet, identify warp and third wire effort, and note overlaps as determined from sighting or telemetry work (Dietrich and Melvin 2007). In order for interactions to first occur birds must be in attendance at the ship. The provision of offal is a key attractant for birds. Zador and Fitzgerald (2008) present results on this issue, based on an observer special project which also will again occur during the 2009 season. Through these completed studies, other ongoing efforts, and proposals submitted for funding we hope to evaluate which fishery sectors have additional seabird interactions and develop an improved monitoring plan to support viable estimates of seabird mortalities.

Acknowledgements
Reporting of seabird bycatch numbers would not be possible without the dedication and hard work of the many North Pacific Groundfish Observers deployed each year. Their efforts are here gratefully acknowledged. Staff of the North Pacific Groundfish Observer Program work to support observers in the field, and to ensure proper quality control measures are integrated into every step of the program, working to ensure that these data are of the highest quality possible. They too deserve credit for their diligence. Mike Perez of the National Marine Mammal Lab conducts the analysis of seabird bycatch each year, with partial financial support from the Alaska Region Protected Resources Division.

Web links
For additional information on seabird regulations, biological opinions, and other related matters, refer to the Alaska Region Protected Resources Division Alaska Seabird Incidental Take Reduction Program and Longline Gear Seabird Avoidance Measures.

For information on North Pacific Groundfish Observer Program protocols see http://www.afsc.noaa.gov/refm/observers

For general fisheries management information also see the North Pacific Fisheries Management Council website at http://www.fakr.noaa.gov/npfmc

For research on seabird avoidance measures and seabird distribution refer to the Washington Sea Grant website at http://www.wsg.washington.edu/research/living/seabirds.html

Table 8. Species and species group categories used in this report. Any species or species group heading not listed in a table means that there was no bycatch in that category[1].

Species/species Group	Includes	Scientific Name
Short-tailed Albatross	n/a	*Phoebastria albatrus*
Laysan Albatross	n/a	*Phoebastria immutabilis*
Black-footed Albatross	n/a	*Phoebastria nigripes*
Unidentified Albatross	Short-tailed, Laysan, or black-footed.	n/a
Northern Fulmar	n/a	*Fulmarus glacialis*
Shearwaters	Unidentified Shearwater	*Puffinus* spp
	Sooty Shearwater	*Puffinus griseus*
	Short-tailed shearwater	*Puffinus tenuirostris*
Unidentified Procellarid	All of the above	Procellariiformes
Gull	Unidentified gull	*Laridae*
	Herring gull	*Larus argentatus*
	Glaucous gull	*Larus hyperboreus*
	Glaucous-winged gull	*Larus glaucescens*
Alcid	Unidentified alcid,	*Alcidae*
	Guillemot	*Cepphus* spp.
	Murre	*Uria* spp.
	Puffin	*Fraturcula* spp.
	Murrelet and auklet	Several genera
Other Seabird	Miscellaneous birds – could include:	
	Loons	*Gaviidae*
	Grebe	*Podicipededae*
	Cormorant	*Phalocrocoracidae*
	Seaduck	*Anatidae*
	Jaeger/skua	*Stercorariidae*
	Kittiwake	*L. tridactyla, L. brevirostris*
	Terns	*Sternidae*
	Storm petrel	*Oceanitidae*
Unidentifid Seabird	All of the above	

[1] A complete list of the species and species group categories used by North Pacific Groundfish Observers while monitoring is available in the Groundfish Observer Manaual (AFSC 2006).

Table 9. Annual estimates of fishery effort, total birds taken, catch rates, and percent hooks observed in Alaskan groundfish demersal longline fisheries by fishery management region and for all Alaskan waters combined, 1993 through 2006.

Area and Year	Effort (No. of hooks in 1,000s)	Number of Birds	95% Confidence Bounds	Incidental catch rate (Birds per 1,000 hooks)	Percent of hooks observed
Aleutian Islands					
1993	37,009.6	2,485	1,927-3,204	0.067	21.1
1994	17,171.1	1,440	1,170-1,771	0.084	25.2
1995	11,846.7	1,531	1,170-2,004	0.129	23.2
1996	11,885.3	791	573-1,088	0.066	25.8
1997	13,177.2	958	698-1,318	0.073	18.9
1998	20,388.2	1,770	1,472-2,129	0.087	25.8
1999	14,588.5	1,901	1,266-2,854	0.130	19.8
2000	28,461.7	1,545	1,144-2,087	0.054	20.7
2001	34,220.7	1,189	906-1,561	0.035	20.7
2002	8,649.0	66	41-107	0.008	31.2
2003	11,294.7	372	236-586	0.033	11.5
2004	10,700.0	124	81-193	0.012	16.9
2005	9,110.6	184	129 - 262	0.020	16.3
2006	11,024.4	181	132 - 248	0.016	18.5
Aleutian Island Average Annual Estimates					
1993-2006	17,109.1	1,038	944-1,142	0.061	21.2
2002-2006	10,155.8	185	149 - 231	0.018	18.4
Bering Sea					
1993	85,605.4	5,364	4,683-6,142	0.063	26.2
1994	118,840.4	9,393	8,446-10,448	0.079	24.2
1995	131,313.3	17,944	16,664-19,323	0.137	24.1
1996	131,832.2	7,814	7,004-8,716	0.060	23.3
1997	176,756.6	20,187	18,404-22,145	0.114	21.2
1998	156,150.3	22,912	21,185-24,780	0.147	23.0
1999	144,070.5	10,396	9,202-11,746	0.072	24.2
2000	164,567.4	16,766	15,278-18,399	0.102	22.3
2001	193,457.1	8,888	8,020-9,849	0.046	20.8
2002	208,861.2	3,805	3,327-4,351	0.018	22.0
2003	267,234.5	4,818	4,348-5,339	0.018	22.6
2004	259,288.4	4,694	4,284-5,141	0.018	19.8
2005	265,103.0	5,762	5,288 - 6,278	0.022	20.9
2006	194,375.1	3,534	2,706 - 4,615	0.018	19.4
Bering Sea Average Annual Estimates					
1993-2006	178,390.3	10,163	9,869-10,466	0.057	22.0
2002-2006	238,972.4	4,522	4,260 -4,801	0.019	21.0
Gulf of Alaska					
1993	56,431.2	1,322	1,090-1,606	0.023	10.2
1994	49,461.6	532	419-676	0.011	4.9
1995	42,775.5	1,544	1,341-1,779	0.036	12.6
1996	33,416.5	1,649	1,273-2,137	0.049	10.7
1997	28,756.6	474	339-663	0.016	9.7

Area and Year	Effort (No. of hooks in 1,000s)	Number of Birds	95% Confidence Bounds	Incidental catch rate (Birds per 1,000 hooks)	Percent of hooks observed
1998	30,029.9	1,587	1,016-2,480	0.053	7.9
1999	32,354.9	965	765-1,216	0.030	8.5
2000	35,813.0	782	484-1,262	0.022	6.4
2001	34,637.8	476	318-710	0.014	7.7
2002	37,501.5	238	143-396	0.006	9.2
2003	53,192.0	511	328-798	0.010	6.5
2004	56,099.1	161	84-307	0.003	5.0
2005	46,660.8	424	314 - 573	0.009	5.3
2006	60,032.1	815	531 – 1,252	0.014	5.8
Gulf of Alaska average annual estimates					
1993-2006	42,654.5	820	742-906	0.019	7.7
2002-2006	50,697.1	430	346-535	0.008	6.2
All Alaska fishery management regions combined					
1993	179,046.2	9,171	8,225-10,226	0.051	20.1
1994	185,473.0	11,364	10,361-12,467	0.061	19.2
1995	185,935.5	21,019	19,657-22,477	0.113	21.4
1996	177,134.0	10,254	9,309-11,291	0.058	21.1
1997	218,699.3	21,619	19,803-23,607	0.099	19.5
1998	206,568.4	26,270	24,380-28,306	0.127	21.1
1999	191,013.9	13,263	11,839-14,858	0.069	21.2
2000	228,842.1	19,093	17,493-20,839	0.083	19.6
2001	262,315.5	10,552	9,609-11,588	0.040	19.1
2002	255,011.7	4,108	3,614-4,669	0.016	20.5
2003	331,721.1	5,701	5,157-6,303	0.017	19.6
2004	326,087.5	4,979	4,554-5,444	0.015	17.2
2005	320,874.4	6,370	5,875-6,906	0.020	18.5
2006	265,431.6	4,530	3,624-5,661	0.017	16.3
All Alaska fishery management regions combined average annual estimates					
1993-2006	238,153.9	12,021	11,701-12,350	0.050	19.4
2002-2006	299,825.3	5,138	4,856-5,435	0.017	18.4

Table 10. Estimated incidental take and actual number of seabirds observed taken in the Aleutian Islands fishery management region groundfish demersal longline fishery, 1993 through 2006. Numbers in parenthesis (shaded rows) are the 95% confidence intervals.

Year	No. Obs.	Albatrosses			Northern Fulmar	Shear-waters	Unid. Procel-larids	Gulls	Alcids	Other Sea-birds	Unid. Seabirds	Totals
		Laysan	Black- footed	Unid.								
		571	12	355	1,017	0	0	184	3	0	343	2,485
1993	550	(437-746)	(5-29)	(228-555)	(611-1,695)			(133-253)	(1-13)		(157-746)	(1,927-3,204)
		307	37	76	434	27	0	24	0	0	535	1,440
1994	388	(228-414)	(17-78)	(50-116)	(300-628)	(8-94)		(21-30)			(348-823)	(1,170-1,771)
		316	23	26	1,006	22	10	99	0	0	29	1,531
1995	390	(176-567)	(11-50)	(16-43)	(689-1,469)	(10-48)	(2-42)	(62-156)			(14-61)	(1,170-2,004)
		106	20	34	160	304	2	23	0	0	142	791
1996	222	(72-155)	(6-70)	(18-64)	(100-254)	(148-623)	(1-7)	(13-42)			(78-258)	(573-1,088)
		270	8	10	599	20	9	10	0	0	32	958
1997	179	(185-394)	(2-36)	(3-32)	(373-963)	(5-73)	(3-28)	(3-32)			(16-64)	(698-1,318)
		449	4	0	638	125	4	167	0	4	379	1,770
1998	460	(295-683)	(1-18)		(474-859)	(83-188)	(1-18)	(109-257)		(1-15)	(243-591)	(1,472-2,129)
		232	18	0	1,535	9	4	100	0	0	5	1,903
1999	399	(178-301)	(7-41)		(933-2,527)	(2-41)	(1-18)	(48-210)			(1-23)	(1,267-2,856)
		196	11	5	1,149	27	0	110	0	0	47	1,545
2000	325	(144-268)	(3-35)	(1-23)	(772-1,712)	(13-56)		(71-171)			(24-92)	(1,144-2,087)
		131	0	0	946	65	0	43	0	0	5	1,189
2001	245	(79-215)			(678-1,319)	(40-103)		(24-76)			(1-22)	(894-1,547)
		47	0	0	10	5	0	4	0	0	0	66
2002	18	(25-86)			(4-25)	(1-23)		(1-15)				(41-107)
		135	0	0	216	0	0	0	0	21	0	372
2003	74	(63-290)			(118-394)					(6-74)		(236-586)
		52	0	0	28	16	0	10	0	0	18	124
2004	24	(27-100)			(13-61)	(3-78)		(3-32)			(8-40)	(81-193)
		50	0	0	32	16	0	85	0	0	0	184
2005	40	(29-87)			13-77	Jun-43		48-151				129-262
		44	3	0	89	0	0	45	0	0	0	181
2006	38	(24-82)	(1-12_		(55-144)			(25-81)				(132-248)
Average Annual Estimates												
		208	10	36	561	45	2	65	0	2	110	1,038
1993-2006	na	(182-236)	(7-14)	(26-50)	(480-657)	(31-66)	(1-4)	(55-77)	(0-1)	(1-5)	(84-143)	(944-1,142)
		66	1	0	75	8	0	29	0	4	4	185
2002-2006	na	(45-95)	(0-2)		(51-110)	(3-19)		(19-43)		(1-15)	(2-8)	(149-231)

Table 11. Estimated incidental take and actual number of seabirds observed taken in the Bering Sea fishery management region groundfish demersal longline fishery, 1993 through 2006. Numbers in parenthesis (shaded rows) are the 95% confidence intervals.

			Albatrosses											
Yr	No. Obs.		Short-tailed	Laysan	Black-footed	Unid.	Northern Fulmar	Shear-waters	Unid. Procel-larids	Gulls	Alcids	Other Sea-birds	Unid. Seabirds	Totals
			0	49	0	0	3,153	65	0	647	11	4	1,435	5,364
1993	1,392			(29-83)			(2,582-3,849)	(34-123)		(430-974)	(4-36)	(1-16)	(1,200-1,716)	(4,683-6,142)
			0	4	0	0	4,555	656	351	1,718	4	4	2,101	9,393
1994	2,312			(1-20)			(3,954-5,247)	(495-870)	(247-499)	(1,333-2,214)	(1-20)	(1-18)	(1,568-2,814)	(8,446-10,448)
			0	148	43	12	8,811	308	474	3,892	4	45	4,207	17,944
1995	4,442			(104-210)	(19-96)	(5-31)	(7,884-9,847)	(221-429)	(295-760)	(3,268-4,635)	(1-17)	(24-84)	(3,538-5,003)	(16,664-19,323)
			4	130	0	27	5,571	185	14	1,484	46	50	303	7,814
1996	1,780		(1-19)	(79-216)		(13-53)	(4,806-6,457)	(118-288)	(6-37)	(1,250-1,762)	(14-144)	(25-103)	(235-389)	(7,004-8,716)
			0	125	4	3	15,187	354	169	3,429	0	9	907	20,187
1997	3,944			(86-183)	(1-19)	(1-15)	(13,505-17,079)	(206-609)	(112-257)	(2,667-4,408)		(3-28)	(606-1,356)	(18,404-22,145)
			8	982	5	4	14,955	1,018	17	4,252	53	45	1,573	22,912
1998	5,390		(3-24)	(720-1,339)	(1-23)	(1-17)	(13,391-16,701)	(846-1,226)	(8-39)	(3,626-4,985)	(31-90)	(23-89)	(1,288-1,926)	(21,185-24,780)
			0	315	0	0	6,082	451	418	2,177	4	49	902	10,396
1999	2,565			(253-387)			(5,048-7,329)	(353-575)	(224-778)	(1,810-2,618)	(1-15)	(23-102)	(625-1,302)	(9,202-11,746)
			0	260	5	10	9,864	539	86	4,454	5	16	1,527	16,766
2000	3,537			(172-391)	(2-21)	(3-29)	(8,558-11,369)	(415-698)	(54-137)	(3,853-5,151)	(1-22)	(8-35)	(1,171-1,992)	(15,278-18,399)
			0	290	5	5	4,602	394	96	2,436	2	33	1,026	8,888
2001	1,742			(204-412)	(1-21)	(1-21)	(3,907-5,420)	(293-528)	(61-153)	(2,053-2,890)	(1-8)	(15-74)	(765-1,376)	(8,020-9,849)
			0	5	0	5	695	149	20	2,537	10	17	367	3,805
2002	859			(1-24)		(1-22)	(585-826)	(102-219)	(7-53)	(2,095-3,071)	(3-32)	(7-40)	(277-485)	(3,327-4,351)
			0	47	10	0	2,768	292	14	1,374	11	45	257	4,818
2003	1,047			(23-94)	(3-32)		(2,427-3,158)	(222-383)	(4-46)	(1,089-1,734)	(4-29)	(26-76)	(192-343)	(4,348-5,339)
			0	37	11	3	1,934	710	97	1,260	39	23	580	4,694
2004	894			(18-74)	(4-36)	(1-10)	(1,661-2,253)	(558-904)	(59-160)	(1,055-1,505)	(20-76)	(11-51)	(448-750)	(4,284-5,141)
			0	18	5	0	2,596	511	0	2,283	16	19	314	5,762
2005	1,209			Jul-44	23-Jan		2,288-2,945	422-619		1,958-2,663	Jun-41	Sep-40	221-445	5,288-6,278
		699	0	3	5	0	1,154	424	0	1,692	6	5	245	3,534
2006				(3-3)	(1-24)		(917-1,452)	(331-541)		(1,002-2,858)	(1-28)	(1-23_	(183-327)	(2,706-4,615)
Average Annual Estimates														
			1	172	7	5	5,852	433	125	2,403	15	26	1,124	10,163
1993-2006		na	(0-2)	(148-201)	(4-11)	(3-8)	(5,604-6,111)	(399-468)	(101-156)	(2,262-2,551)	(11-22)	(21-33)	(1,036-1,220)	(9,869-10,466)
		na	0	22	6	2	1,829	417	26	1,829	17	22	352	4,522
2002-2006				(14-34)	(3-13)	(1-5)	(1,705-1,963)	(371-469)	(17-40)	(1,613-2,075)	(11-26)	(15-31)	(308-403)	(4,260-4,801)

Table 12. Estimated incidental take and number of seabirds observed taken in the Gulf of Alaska fishery management region groundfish demersal longline fishery, 1993 through 2006. Numbers in parenthesis (shaded rows) are the 95% confidence intervals.

		Albatrosses										
Year	No. Obs.	Laysan	Black-footed	Unid.	Northern Fulmar	Shear-waters	Unid. Procel-larids	Gulls	Alcids	Other Sea-birds	Unid. Sea-birds	Totals
		128	29	3	842	59	0	45	0	3	213	1,322
1993	318	(78-211)	(15-57)	(1-14)	(648-1,094)	(31-114)		(23-90)		(1-11)	(131-346)	(1,090-1,606)
		169	7	8	258	26	0	30	0	0	33	531
1994	126	(106-269)	(2-22)	(3-24)	(181-368)	(10-70)		(7-127)			(13-84)	(419-676)
		68	239	378	529	40	6	105	0	4	175	1,544
1995	374	(42-109)	(181-317)	(290-493)	(381-733)	(20-81)	(1-25)	(67-166)		(2-11)	(120-256)	(1,341-1,779)
		155	665	0	674	15	0	121	0	0	19	1,649
1996	250	(104-233)	(490-903)		(424-1,071)	(4-52)		(30-498)			(6-57)	(1,273-2,137)
		31	97	0	281	8	0	47	0	0	10	474
1997	74	(7-127)	(51-187)		(177-449)	(2-24)		(24-93)			(3-33)	(339-663)
		241	321	4	952	13	0	57	0	0	0	1,588
1998	184	(117-495)	(125-825)	(1-18)	(506-1,788)	(4-42)		(29-116)				(1,016-2,480)
		214	184	0	242	50	0	249	0	9	16	964
1999	159	(147-312)	(91-370)		(165-354)	(21-118)		(145-430)		(2-43)	(5-55)	(765-1,216)
		96	155	0	317	0	0	180	0	0	34	782
2000	72	(47-195)	(89-271)		(140-716)			(55-592)			(7-174)	(484-1,262)
		69	73	17	191	20	0	96	6	0	3	475
2001	45	(29-165)	(36-146)	(4-86)	(116-314)	(4-99)		(25-365)	(1-29)		(1-14)	(318-710)
		0	33	0	107	0	0	81	0	0	17	238
2002	51		(17-65)		(52-219)			(27-237)			(6-44)	(143-396)
		12	155	0	233	0	0	49	46	0	16	511
2003	37	(5-30)	(58-417)		(124-436)			(16-149)	(8-270)		(3-80)	(328-798)
		31	24	0	0	0	0	93	0	0	13	161
2004	17	(11-88)	(10-58)					(35-244)			(3-62)	(84-307)
		15	38	0	156	33	0	160	0	0	23	424
2005	67	Jun-38	9-150		95-256	15-76		107-239			13-May	314-573
		10	126	0	212	5	0	423	0	0	40	815
2006	105	(3-32)	(54-298)		(120-374)	(1-20)		(208-859)			(14-116)	(531-1,252)
Average Annual Estimates												
		89	153	29	357	19	0	124	4	1	44	820
1993-2006	na	(72-109)	(123-191)	(23-38)	(301-423)	(14-27)	(0-2)	(93-167)	(1-19)	(1-3)	(33-57)	(742-906)
		14	75	0	142	8	0	161	9	0	22	430
2002-2006	na	(8-25)	(44-130)		(103-194)	(4-16)		(105-247)	(2-54)		(11-43)	(346-535)

Table 13. Seabird avoidance measures used by demersal groundfish longline vessels, 2004 -- 2006. Data are from observer spot-checks of set operations from catcher-processor (CP) and catcher (CV) vessels in the Aleutian Islands (AI), Bering Sea (BS), and Gulf of Alaska (GOA).

						Use of Streamer Lines in Examined Sets			
Region	Vessel Type	Total Sets	Sets not checked	Sets Checked	% sets checked	Paired Streamers	Single Streamer	No Streamers	% Paired or Single
AI	CV	61	9	52	85.2	35	17	0	100.0
AI	CP	4,234	1,705	2,468	58.3	2,261	69	138	94.4
BS	CV	290	21	269	92.8	237	28	4	98.5
BS	CP	44,621	15,286	29,335	65.7	25,405	2,781	1,149	96.1
GOA	CV	2,945	554	2,391	81.2	2,066	230	95	96.0
GOA	CP	4,542	1,686	2,856	62.9	2,685	90	81	97.2
Total		56,632	19,261	37,371	66.0	32,689	3,215	1,467	96.1

Table 14. Estimated incidental take and actual number of seabirds observed taken in the demersal pot fishery in Alaskan waters, 1993 through 2006, all fishery management regions combined. Numbers in parentheses (shaded rows) are the 95% confidence intervals.

Year	No. Obs.	Northern Fulmar	Shearwaters	Unid. Procellarids	Gulls	Alcids	Other Seabirds	Unid. Seabirds	Totals
1993	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0
1995	6	9	7	0	4	19	0	0	39
		(3-33)	(1-33)		(1-15)	(4-92)			(15-103)
1996	9	80	0	2	0	0	0	7	89
		(27-235)		(1-8)				(2-30)	(33-238)
1997	4	16	0	0	0	11	0	0	27
		(6-43)				(2-52)			(10-68)
1998	2	19	0	0	15	0	0	0	34
		(4-92)			(3-73)				(10-114)
1999	47	166	9	14	0	0	0	0	189
		(95-290)	(2-43)	(5-35)					(114-313)
2000	1	0	0	0	0	0	0	42	42
								(9-207)	(9-207)
2001	3	14	0	0	3	0	0	0	17
		(4-52)			(1-12)				(6-53)
2002	6	18	0	0	0	0	0	3	21
		(8-42)						(1-13)	(10-44)
2003	10	91	4	0	0	59	0	0	154
		(36-230)	(1-16)			(12-290)			(63-372)
2004	5	60	0	0	0	0	0	0	60
		(20-183)							(20-183)
2005	11	102	13	0	0	0	0	0	115
		(29-363)	(5-34)						(36-364)
2006	17	219	7	0	0	0	4	0	230
		(84-570)	(1-31)				(1-19)		(92-575)
Average Annual Estimates									
1993-2006	na	57	3	1	2	6	0	4	73
		(38-85)	(1-6)	(1-3)	(0-5)	(2-21)	(0-1)	(1-15)	(51-103)
2002-2006	na	98	5	0	0	12	1	1	116
		(55-175)	(2-10)			(2-58)	(0-4)	(0-3)	(68-196)

Table 15. Estimated incidental take and actual number of seabirds observed taken in the Aleutian Islands fishery management region groundfish trawl fleet, 1993 through 2006.

Year	No. Obs.	Laysan Albatross	Unidentified Albatross	Northern Fulmar	Shearwaters	Gulls	Alcids	Unidentified Seabirds	Totals
1993	3	0	0	0	440	0	0	0	440
					(107 – 1,812)				(107 – 1,812)
1994	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0	0
1996	1	0	0	0	0	0	0	215	215
								(39 - 1,181)	(39 – 1,181)
1997	4	133	0	0	0	0	0	42	175
		(15 – 1,197)						(3 - 649)	(24 – 1,279)
1998	9	313	0	11	0	2	0	0	326
		(74 – 1,314)		(2 - 65)		(0 - 58)			(81 – 1,309)
1999	21	9	0	157	8	0	0	0	174
		(4 - 17)		(32 - 777)	(1 - 50)				(63 - 477)
2000	7	0	0	121	0	0	0	0	121
				(29 - 499)					(29 - 499)
2001	11	8	0	253	467	0	0	0	728
		(1 - 61)		(52 – 1,234)	(135 – 1,619)				(261 – 2,032)
2002	8	2	0	189	0	0	0	0	191
		(1 - 13)		(63 - 567)					(65 - 567)
2003	6	166	0	202	0	86	86	0	540
		(25 – 1,130)		(40 – 1,023)		(17 – 441)	(17 - 441)		(186 – 1,559)
2004	3	0	0	298	0	0	0	0	298
				(73 – 1,218)					(73 – 1,218)
2005	5	56	0	191	0	0	0	0	247
		(9 - 357)		(52 - 701)					(79 – 774)
2006	4	0	2	8	126	0	0	0	137
			(1-115)	(2-226)	(24-656)				(28-679)
Average Annual Estimates									
1993 – 2006	n/a	49	0	102	74	6	6	18	255
		(17 - 143)	(0-8)	(54 - 193)	(30 - 184)	(1 - 32)	(1 – 32)	(4 - 91)	(163 – 404)
2002-2006	n/a	45	0	177	25	17	17	0	281
		(9 - 225)	(0-23)	(81 - 386)	(5 - 131)	(3 - 88)	(3 - 88)		(150 - 528)

Table 16. Estimated incidental take and actual number of seabirds observed taken in the Bering Sea fishery management region groundfish trawl fleet, 1993 through 2006.

		Albatross									
Year	No. Obs.	Laysan	Unidentified	Northern Fulmar	Shearwaters	Unident. Procel-larids	Gulls	Alcids	Other Seabirds	Unidentified Seabirds	Totals
		0	224	0	27	4	0	2	0	64	321
1993	20		(16-3,243)		(27-27)	(1-17)		(2-2)		(4-1,106)	(33-3,177)
		0	0	57	89	0	6	0	0	8	160
1994	45			(8-402)	(22-366)		(1-45)			(3-25)	(50-515)
		0	95	29	0	0	0	9	0	110	243
1995	19		(14-666)	(8-106)				(1-61)		(19-648)	(68-870)
		0	0	26	2	10	6	3	0	14	61
1996	18			(9-78)	(0-23)	(2-58)	(1-33)	(1-16)		(5-40)	(30-121)
		0	0	13	135	0	0	200	0	142	490
1997	50			(4-42)	(84-218)			(40-1,008)		(36-559)	(205-1,176)
		0	0	134	81	2	421	283	2	11	934
1998	35			(26-686)	(1-9,839)	(1-4)	(5-38,403)	(111-722)	(0-25)	(3-41)	(21-42,600)
		0	0	484	170	0	0	229	5	14	901
1999	131			(253-927)	(59-484)			(4-13,003)	(2-13)	(3-67)	(327-2,483)
		0	0	253	18	5	64	3	0	121	463
2000	93			(133-481)	(10-31)	(2-13)	(9-476)	(1-10)		(27-543)	(237-904)
		3	0	225	20	21	10	3	6	159	446
2001	129	(1-12)		(189-266)	(10-41)	(11-42)	(4-24)	(1-11)	(2-17)	(33-768)	(232-857)
		0	0	184	11	0	9	11	2	116	333
2002	58			(42-818)	(6-21)		(6-13)	(6-20)	(0-37)	(25-541)	(115-966)
		0	0	156	3	3	2	11	0	3	177
2003	70			(89-275)	(1-12)	(1-11)	(0-67)	(5-24)		(1-11)	(107-294)
		0	0	162	85	0	3	131	7	21	410
2004	65			(82-321)	(22-321)		(1-13)	(28-622)	(3-18)	(7-64)	(204-826)
		0	0	266	213	0	0	830	0	3	1,312
2005	119			(183-387)	(11-4,190)			(160-4,307)		(1-11)	(327-5,257)
		1	0	417	20	2	199	3	0	2,092	2,735
2006	166	(1-34)		(245-711)	(12-35)	(1-5)	(39-1,013)	(1-12)		(411-10,645)	(722-10,365)
Average Annual Estimates											
		0	23	172	59	3	51	101	2	206	616
1993- 2006	n/a	(0-2)	(2-220)	(132-223)	(10-698)	(2-6)	(1-2,910)	(13-782)	(1-3)	(57-743)	(163-2,329)
		0	0	236	55	1	42	138	2	447	921
2002- 2006	n/a	(0-7)		(166-337)	(29-106)	(0-2)	(9-201)	(36-523)	(1-6)	(95-2,109)	(383-2,219)

[1] Observers were instructed to use the largest sample size available when monitoring for seabirds. Alt 1 likely represents a closer approximation of estimated incidental takes.

Table 17. Estimated incidental take and actual number of seabirds observed taken in the Gulf of Alaska fishery management region groundfish trawl fleet, 1993 through 2006.

Year	Total Catch	Northern Fulmar	Shear-waters	Unid. Procel-larids	Alcids	Unid. Seabirds	Totals
1993	1	0	52	0	0	0	52
			(10-286)				(10-286)
1994	0	0	0	0	0	0	0
1995	2	0	26	0	0	2	28
			(5-139)			(2-2)	(6-138)
1996	1	0	0	3	0	0	3
				(2-3)			(2-3)
1997	1	73	0	0	0	0	73
		(15-366)					(15-366)
1998	1	98	0	0	0	0	98
		(20-497)					(20-497)
1999	2	0	0	0	11	0	11
					(0-696)		(0-696)
2000	1	116	0	0	0	0	116
		(22-625)					(22-625)
2001	1	48	0	0	0	0	48
		(9-254)					(9-254)
2002	3	239	0	0	0	0	239
		(79-724)					(79-724)
2003	2	186	0	0	0	0	186
		(54-645)					(54-645)
2004	1	0	0	0	7	0	7
					(3-17)		(3-17)
2005	1	0	0	0	3	0	3
					(1-6)		(1-6)
2006	0	0	0	0	0	0	0
Average Annual Estimates							
1993- 2006	n/a	54	6	0	2	0	63
		(28-106)	(1-22)		(0-50)		(29-139)
2002-2006	n/a	85	0	0	2	0	87
		(36-202)			(1-3))		(37-203)

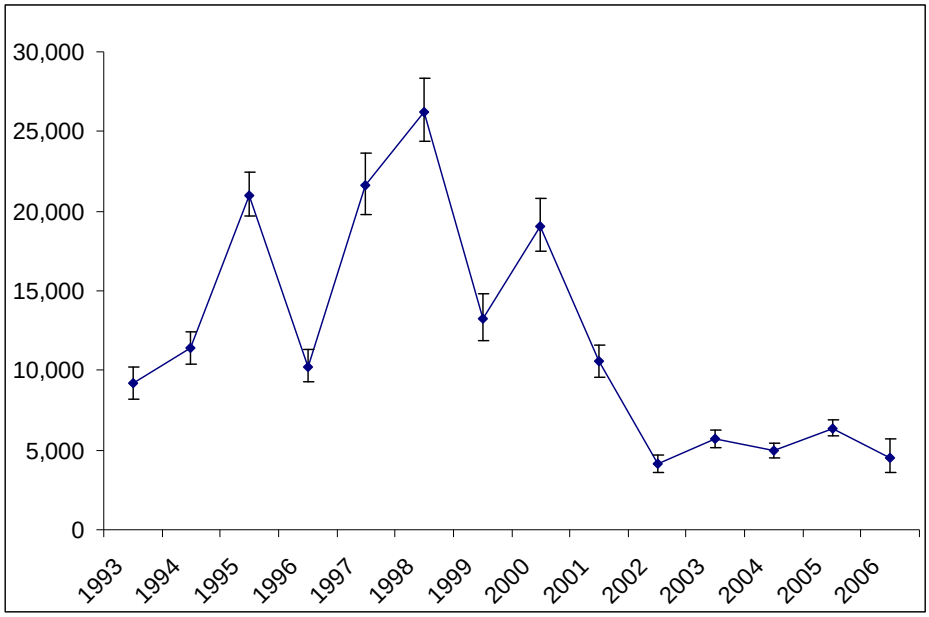

Figure 73. Total incidental take of seabirds in Alaskan combined demersal longline groundfish fisheries, 1993 through 2006. Mitigation measures (streamer lines) were voluntarily implemented by a large part of the fleet in 2002, followed by regulations in 2004 that required all groundfish longline vessels that observers monitor to deploy mitigation measures.

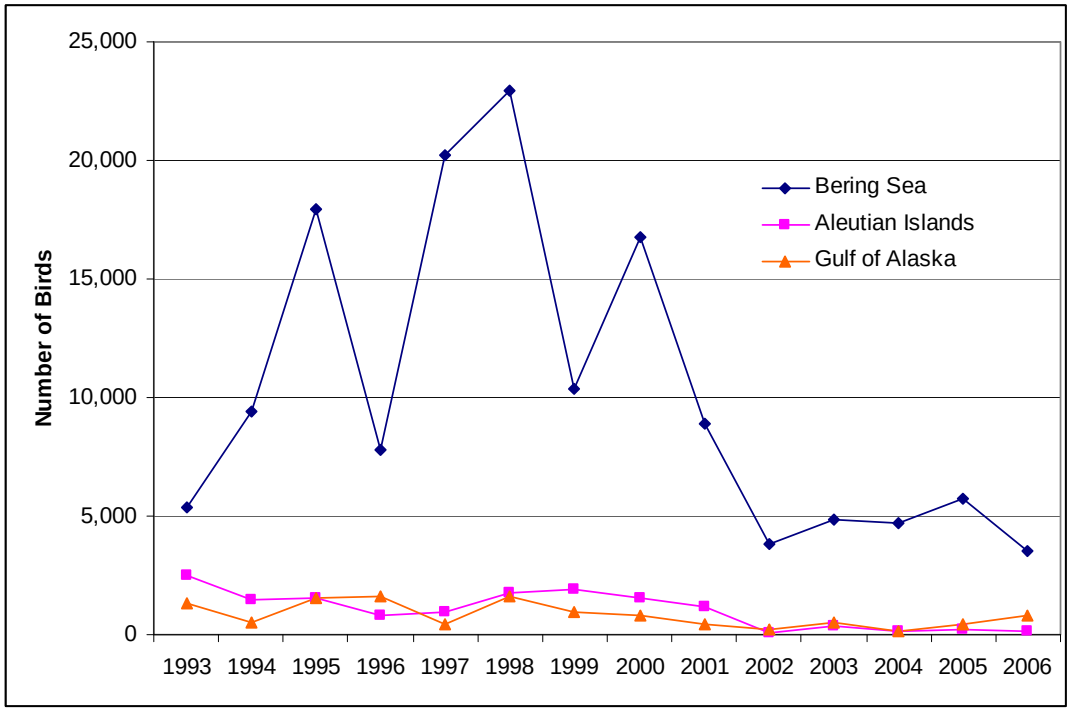

Figure 74. Seabird bycatch in the Alaskan demersal groundfish longline fisheries by Fishery Management Region, 1993 through 2006.

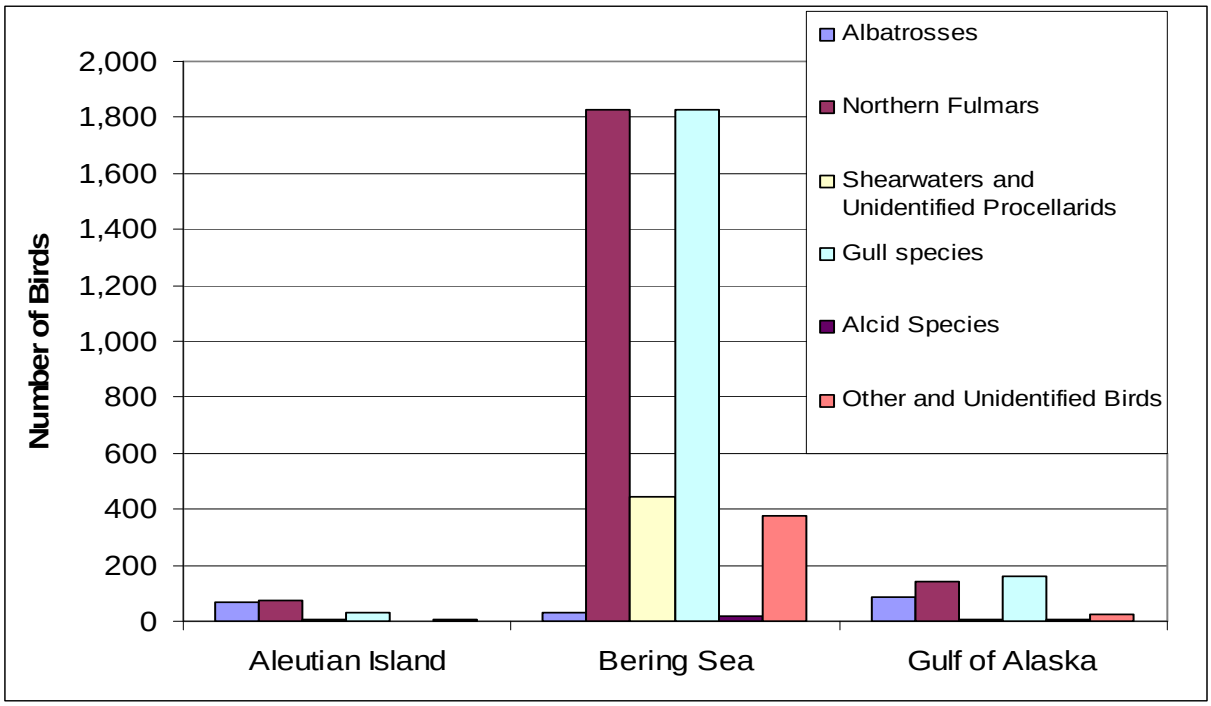

Figure 75. Species composition of the Alaskan groundfish longline fishery, by region, based on estimates of the 2002-2006 annual average mortality.

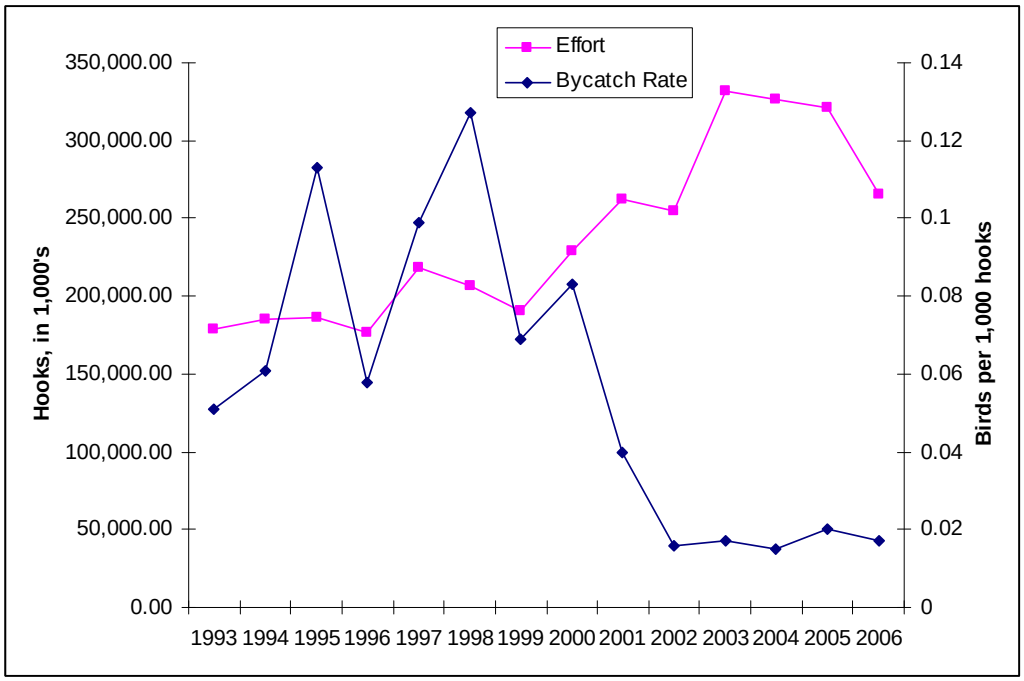

Figure 76. Total estimated hooks (in thousands) and bycatch rate of birds (birds per 1,000 hooks) in the Alaskan demersal groundfish longline fishery, 1993 through 2006.

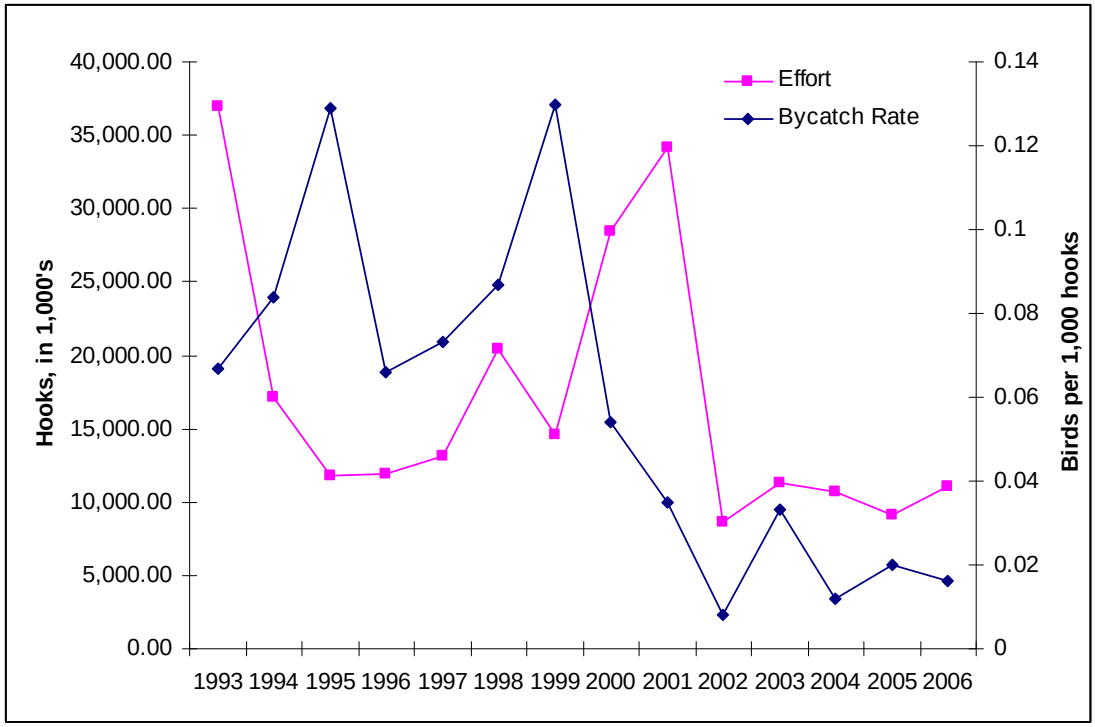

Figure 77. Total estimated hooks (in thousands) and bycatch rate of birds (birds per 1,000 hooks) in the Aleutian Islands demersal groundfish longline fishery.

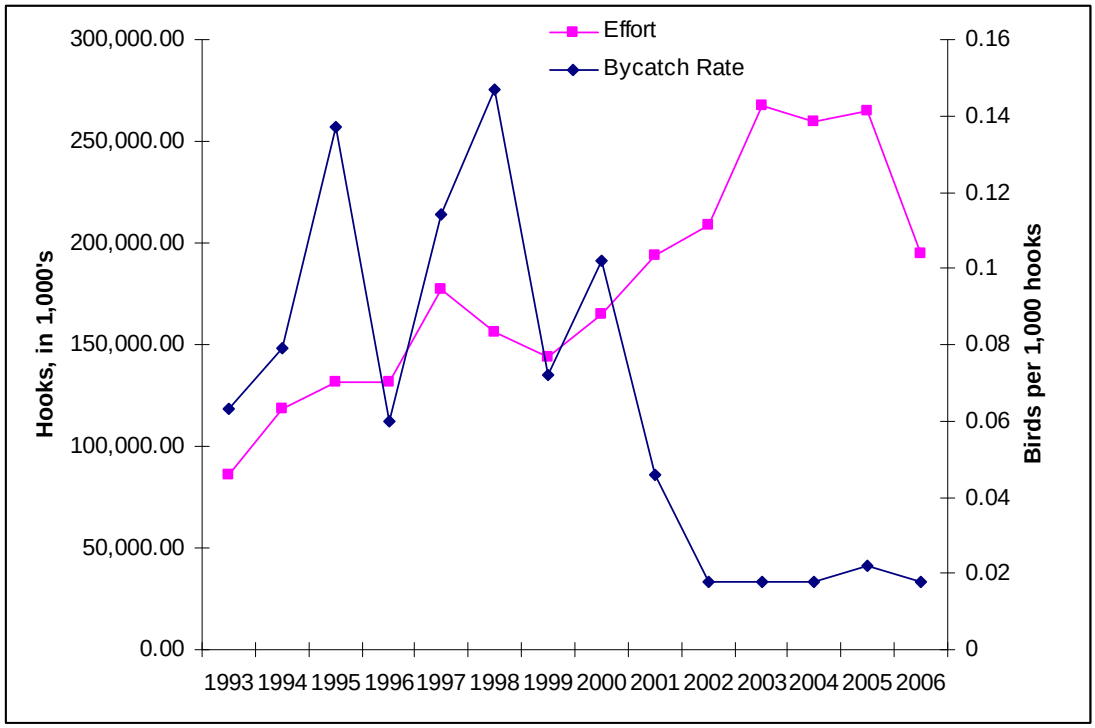

Figure 78. Total estimated hooks (in thousands) and bycatch rate of birds (birds per 1,000 hooks) in the Bering Sea demersal groundfish longline fishery.

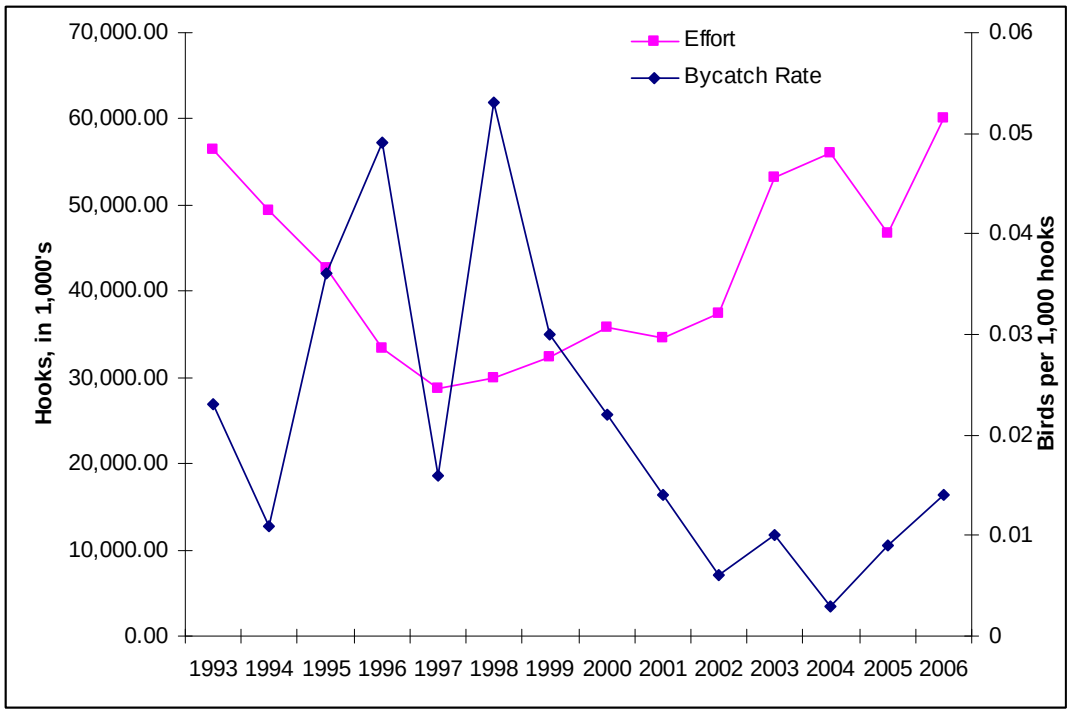

Figure 79. Total estimated hooks (in thousands) and bycatch rate of birds (birds per 1,000 hooks) in the Gulf of Alaska demersal groundfish longline fishery.

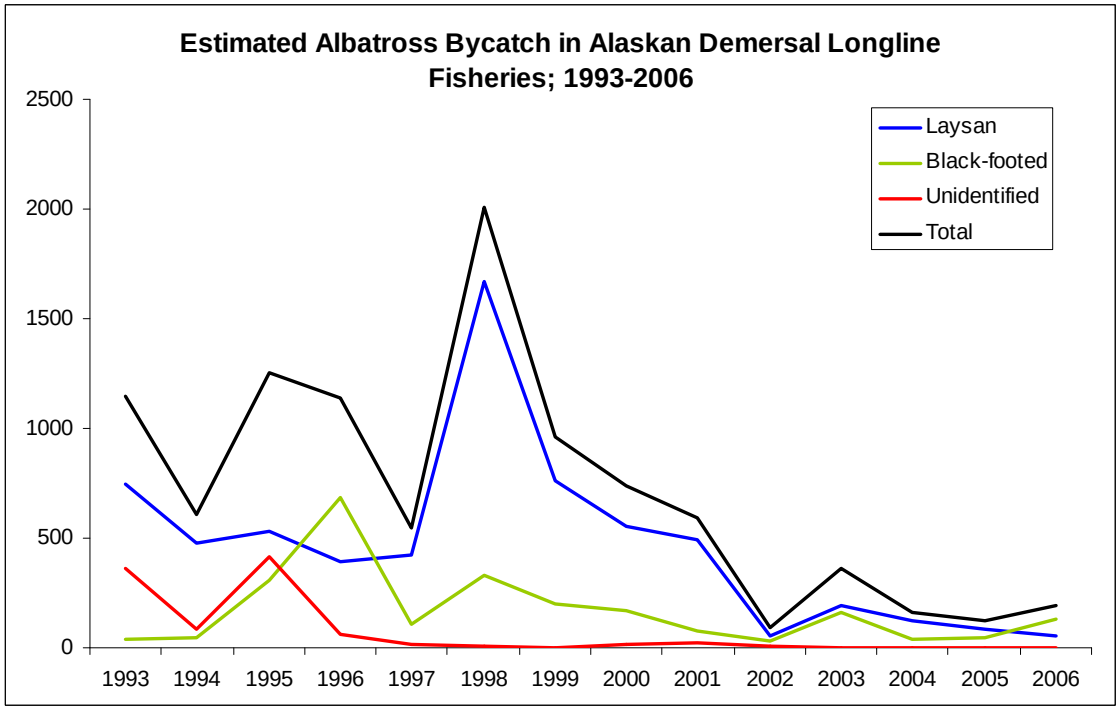

Figure 80. Estimated Albatross bycatch in the Alaskan demersal longline fisheries, 1993-2006.

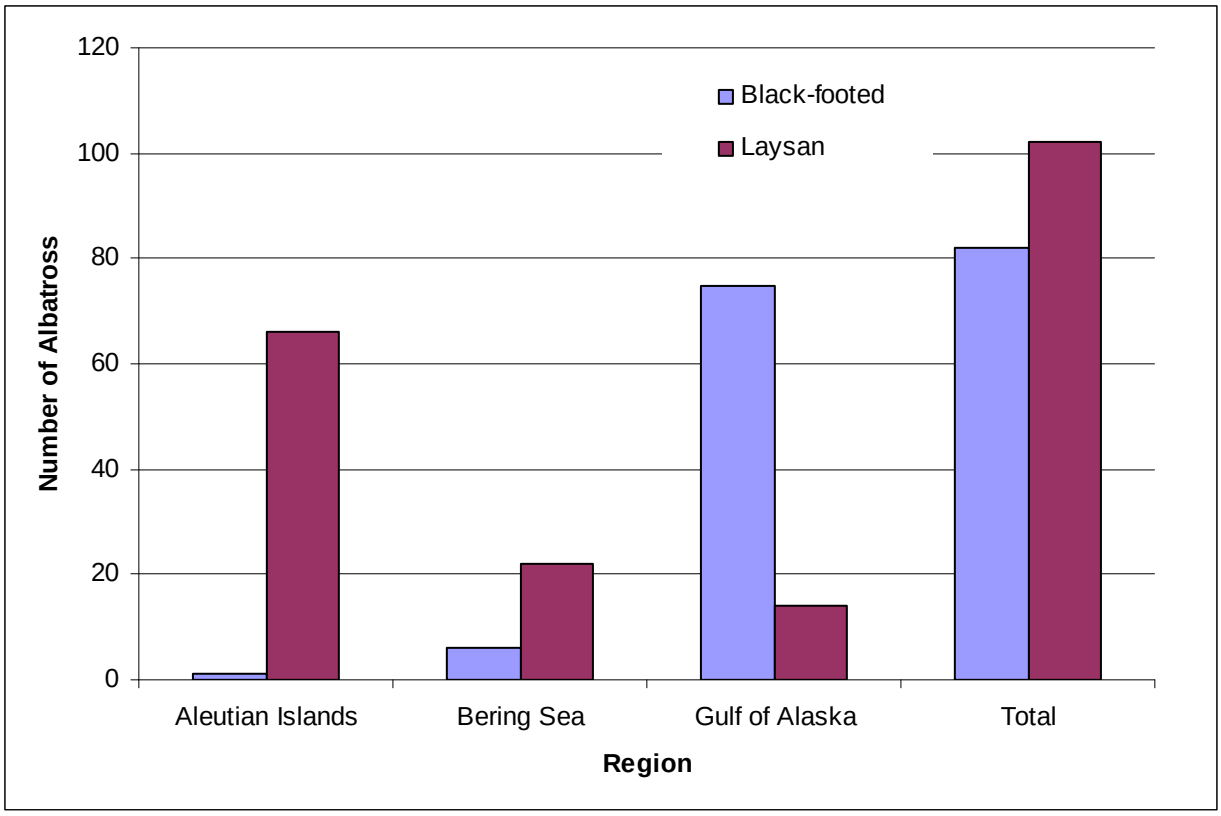

Figure 81. Estimated annual average albatross bycatch, 2002 through 2006, by Alaska demersal longline fisheries.

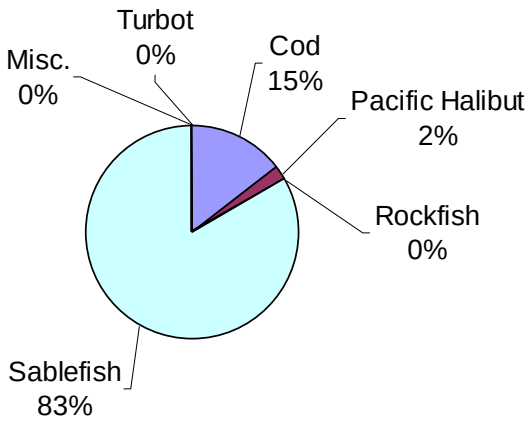

Figure 82. Proportion of Black-footed albatross taken by longline fisheries based on target species.

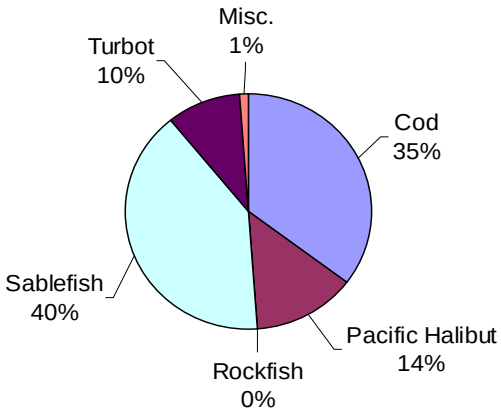

Figure 83. Proportion of Laysan Albatross taken by longline fisheries based on target species.

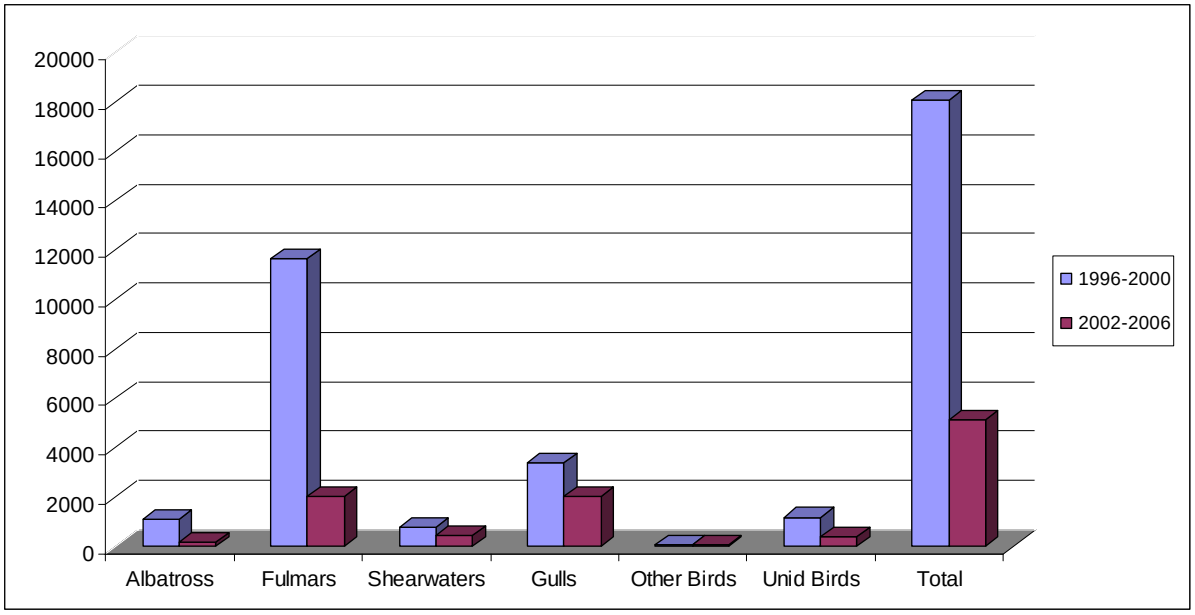

Figure 84. Seabird bycatch in the Alaskan demersal longline fishery during the 5 years periods before and after streamer line usage was widespread. Streamer lines were not required by regulation until early 2004, but the majority of freezer longliners had voluntarily started using them in 2002-2003.

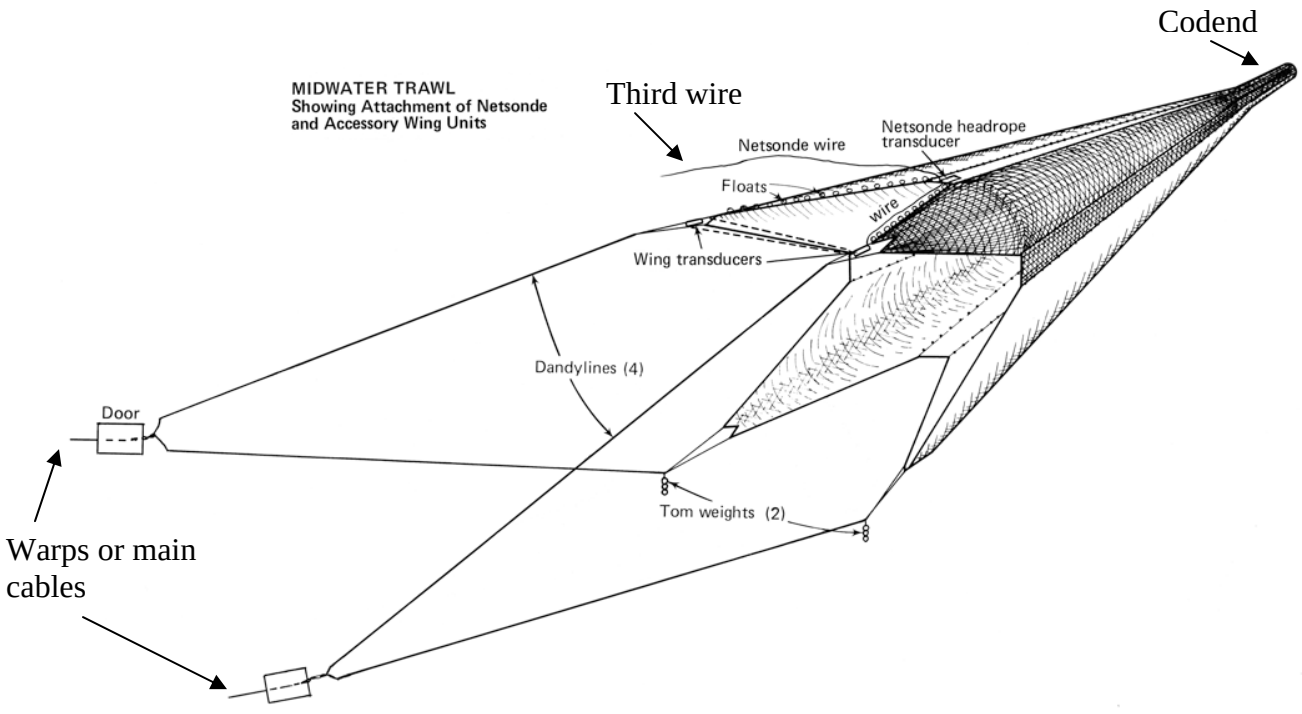

Figure 85. A midwater trawl.

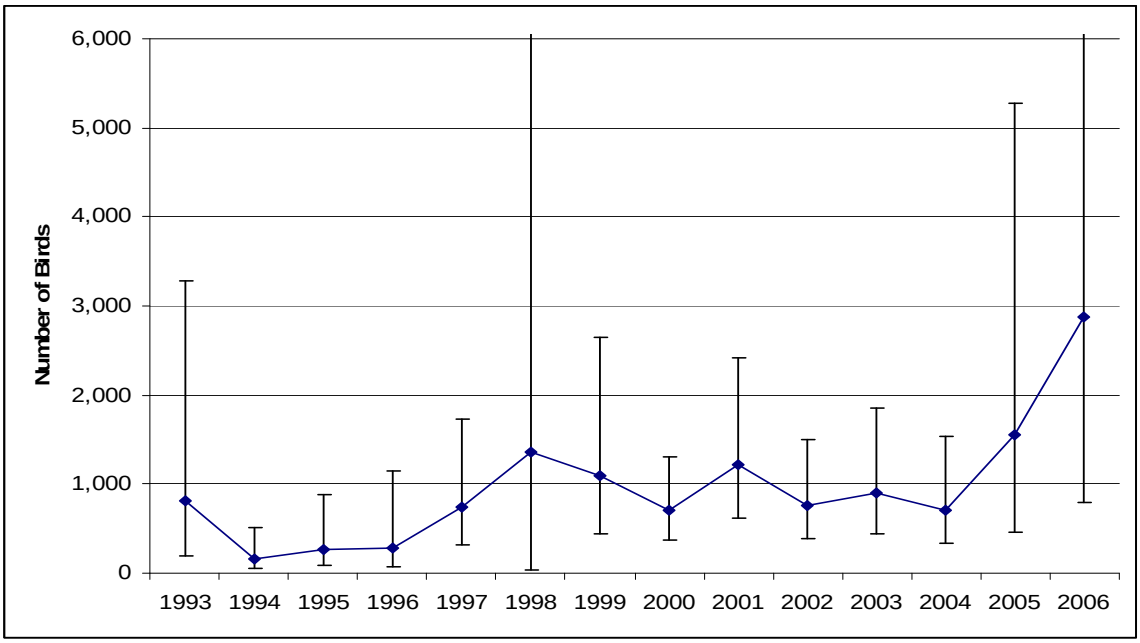

Figure 86. Seabird bycatch estimates for the Alaskan groundfish trawl fleet using the best available estimates, 1993-2006. Upper confidence intervals for 1998 and 2006 exceed 10,000 birds.

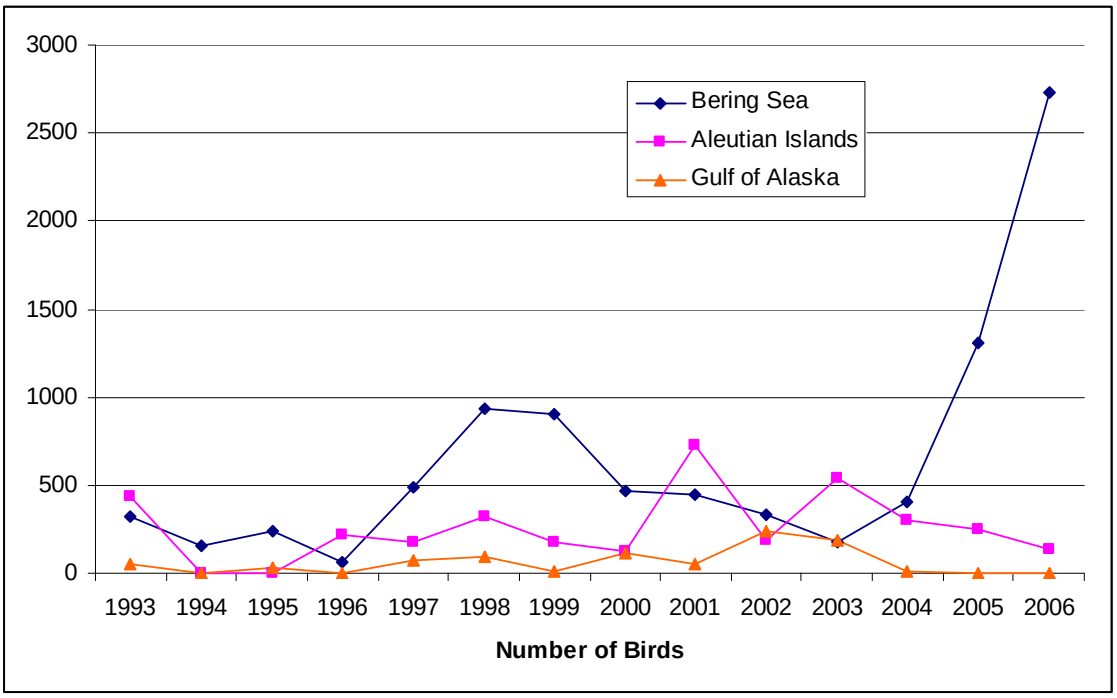

Figure 87. Seabird bycatch in groundfish trawl fisheries by area, using the best available estimates, 1993-2006.

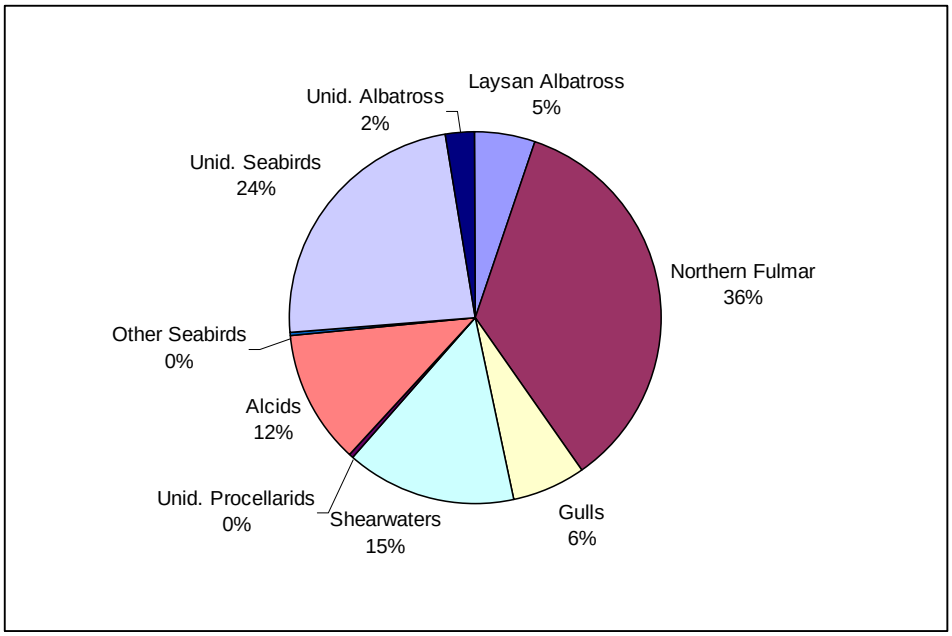

Figure 88. Species composition of seabird bycatch in the combined Alaskan groundfish trawl fisheries using the average annual estimates, 1993 through 2006.

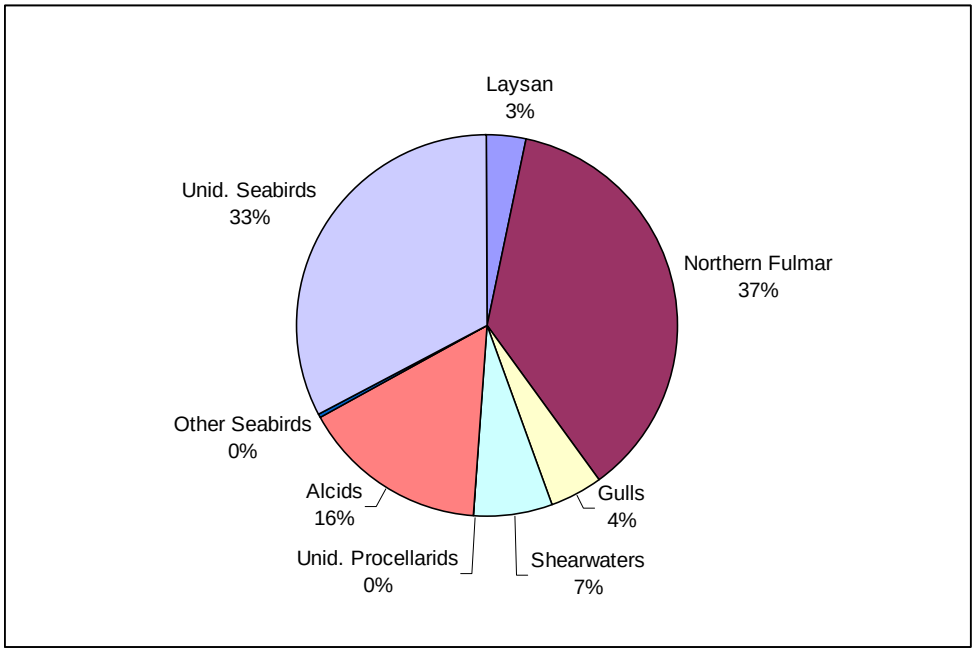

Figure 89. Species compostion of seabird bycatch in the combined Alaskan groundfish trawl fisheries using the average annual estimates 2002 through 2006.

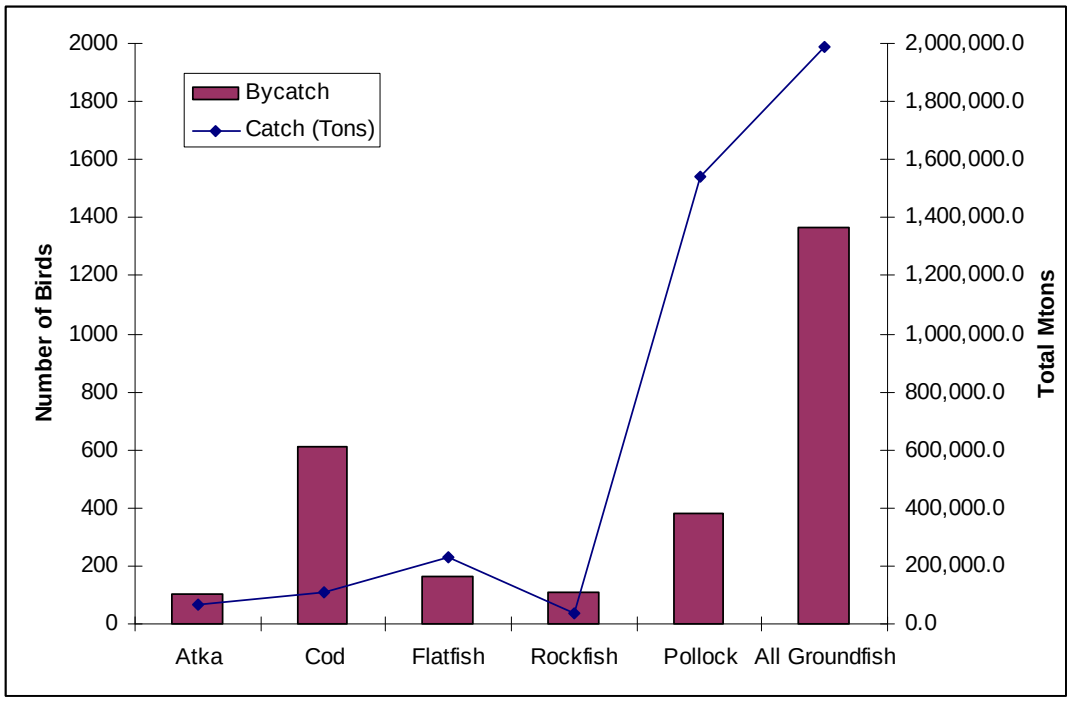

Figure 90. The annual average seabird bycatch levels for the period 2002-2006 and total fishery catch in metric tons by Alaskan groundfish trawl fisheries.

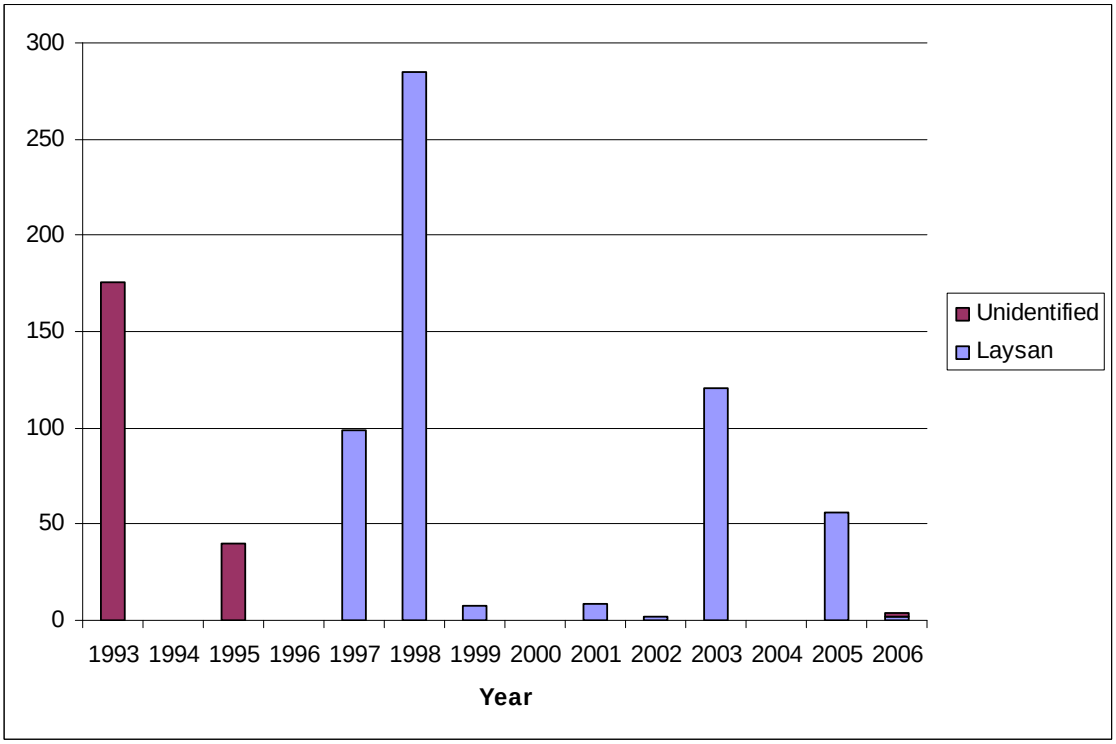

Figure 91. Albatross bycatch in the Alaskan groundfish trawl fishery.

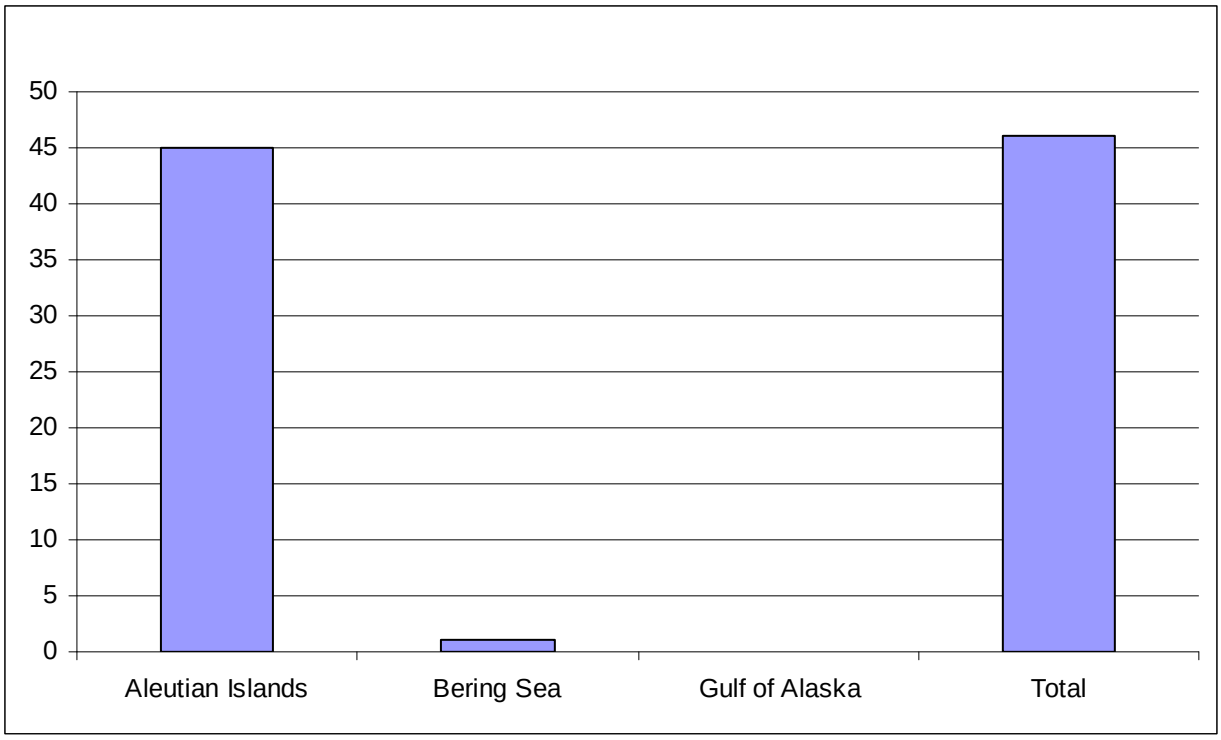

Figure 92. Five-year (2002-2006) average annual bycatch of Laysan albatross in the groundfish trawl fishery, by region. All albatross bycatch in the Aleutian Islands is from the cod fishery; Bering Sea albatross bycatch is in the pollock fishery.